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# **PROCEEDING**

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# SCHEDULING FUNGICIDE APPLICATION ON PURPLE BLOTCH DISEASE (*Alternaria porri*) BASED ON WEATHER DATA: AN EFFORT TO OPTIMIZE ECONOMIC RETURN OF SHALLOT PRODUCTION

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## ABSTRACT

The objective of this research was to characterize disease severity of purple blotch on several weather conditions and to determine spraying interval of fungicide based on economic return of shallot production in Malang, East Java. Disease severity data on several weather conditions was obtained from field experiments and literature. Disease inoculation was naturally occurred with fungicide application 5, 7, 10, and 15-day interval and without fungicide. Randomized block design with four replications was used in this study. Compilation data was analysed to make regression model in forecasting long-pattern disease severity. Probability value of disease severity was used to calculate expected net return. The result of this study showed that the highest economic return was obtained from fungicide application with interval spraying 5-day, that is, Rp. 25.664.000,- per ha.

Keywords : Expected net return, Fungicide, Purple blotch, Shallot, Weather data

## INTRODUCTION

Efforts to know the effect of weather on the development of purple blotch disease in onion crop in the cropping areas is not easy. This is because the pathogen has a particular sensitivity to weather factors that are always changing and different from one place to another. In addition to obtaining data that disease progression is influenced by weather factors without the use of fungicides is very limited. According to Koster et al. (1989) in Suhardi (1993) states that the onion disease control in general intensive use of fungicide for at least two times each week during the growing season.

The intensity of purple blotch disease can vary once each year in the onion cropping areas. Differences in disease severity over the years allegedly arising from differences in environmental conditions especially humidity level between planting seasons. This was stated by Hadisutrisno, Sudarmaji, Subandiyah and Priyatmojo (1995) that daily conidia dispersal, which is one important component in the epidemic of purple blotch disease is influenced by temperature, relative humidity and wind speed.

These variations can cause shallot farmers to invest too much in some years and less in other years. Seasonal variations in disease severity can also affect the interpretation of research in the field. The quantitative description of the purple blotch disease more than two or three years had never been compiled. So that variations from year to year against purple blotch disease there has been no characterization. According Hadisutrisno and Triharso (1989) in Hadisutrisno et al. (1996) states that *Alternaria porri* purple blotch disease has a long cycle but the data on the influence of weather factors on the development of purple blotch disease is still limited. Given the research data Suhardi (1993) about the effect of planting time on disease severity of *A. porri* on onion, then it can be developed predictive model of the influence of weather factors on the development of purple blotch disease. The purpose of this study was to investigate the relationship between weather and purple blotch disease that could be useful to estimate and calculate the intensity of purple blotch disease in the long term in Karangploso, Malang and calculate the economic value of expected net return in controlling purple blotch disease.

## MATERIALS AND METHODS

Daily rainfall, temperature, and relative humidity were obtained for Malang for ten years from records maintained at weather station, Karang Ploso, Malang. The number of rainy days in a week, the number of days in which temperatures over 30 °C in a week, the number of days with relative humidity > 75% and with relative humidity > 90% were counted. Disease data were tabulated from replicated unsprayed plots in fungicide tests conducted by using the cultivar Bima at various locations.

The disease severity per plot calculated as follows:

$$P = \frac{\sum (v \times n)}{V \times N} \times 100 \%$$

In which  $P$  = disease severity (%),  $v$  = index category of severity,  $n$  = number of plants in each category of severity,  $V$  = index of the highest category of severity,  $N$  = number of plant samples. The damage criteria: 0 = no lesions; 1 = 1 - <25%; 2 = 26 - <50%; 3 = 51 - <75%; 4 = 76 - <99%; 5 = 100% or die

The disease severity ( $Y$ ) regressed against the initial inoculum ( $X_1$ ) number of days ( $X_2$ ) in which rainfall, temperature, and humidity assumed conducive for purple blotch disease progression. The calculated weather data were selected by trial and error to make regression analysis. The resulting model was used along with the weather data for one year to estimate annual purple blotch severities. The estimate severities were grouped into several classes of severities with length of 20 to obtain the relative frequency distribution and cumulative probability.

Economic returns from various fungicides applied according to different schedule were determined from purple blotch control test. Research conducted in the village of Karang Ploso, Malang, with a height of 500 m above sea level on which is a purple blotch disease endemic areas. Experiments were conducted from October until December 2008. Experiments were arranged in randomized block design with four replications. Plots grouped into as many replications. Grouping is based on the gradient flow of water. Each plot has a width of 1 m and length 5 m. Furthermore, spacing between plants in rows 15 cm and 20 cm between rows. Two rows from the edge of the plants in each plot used as a border plant. Treatment includes the frequency of use of fungicides at intervals of 5, 7, 10, and 15 days. Treatments included an unsprayed control as well as applications of fungicide Othane (Mancozeb with adhesive Triton (0.10%), Manure, 80 kg  $P_2O_5$  / ha was applied before planting, 150 kg fertilizer N / ha and 50 kg  $K_2O$  / ha was given twice on 10 and 40- day after planting. Gross returns were calculated for each treatment from yield and market grade data. Net returns to purple blotch management were obtained by subtracting estimated cost associated with each control option from the appropriate gross returns.

Expected net return ( $ENR$ ) for each fungicide application schedule combination was calculated as follows:

$$E(NR) = \sum_{j=1}^n P(\theta_j) R_{nj}$$

Where  $P(\theta_j)$  = the estimated probability of the occurrence of the  $j$ th class of disease severity,  $R_{nj}$  = net return of the 1, ...,  $n$  fungicide spray schedule combinations.

## RESULTS AND DISCUSSION

The models generated from different combinations of variables iteratively shows that the most appropriate model is  $Y = 2.85 + 0.61 X_1 + 0.27 X_1 X_2$  with coefficient determination ( $R^2$ ) = 0.67 (Table 1).

Table 1. Coefficients determination ( $R^2$ ) between disease severity of purple blotch on shallot and environmental variables.

Model	$R^2$
$Y = -1.45 + 1.71 X_1 + 0.76 X_2$	0.78
$Y = 2.85 + 0.61 X_1 + 0.27 X_1 X_2$	0.67
$Y = -1.35 + 0.01 X_1^2 + 1.3 X_1$	0.32
$Y = 2.86 + 0.39 X_1 X_2$	0.76

$X_1$  = initial inoculum,  $X_2$  = number of days in which relative humidity  $\geq 90$

This indicates that the amount of intensity is influenced by the presence of initial inoculum or initial infection and relative humidity above 90 percent. So that, in this model the variation of intensity is determined by the amount of the initial infection and interaction between initial infection and the relative humidity. This result is supported by a statement of Kranz (1974) that in linear model increased infection can not occur only with initial inoculum without moisture variable.

This model used to simulate weather data to predict the disease severity. The resulting simulation from a one-year weather data were obtained the relative frequency of disease severity and the cumulative probability as showed in Figure 1 and 2.

In Figure 2 could be known that the probability value of less severity than 21 percent was 0.42, while for the value of the probability that of more than 21 percent was 0.58. This indicates that the epidemic of purple blotch disease in Malang areas with intensity less than 21 percent will occur with a probability of 42 percent. While epidemic with disease severity more than 21 percent will occur with a probability of 58 percent for crops seasons.



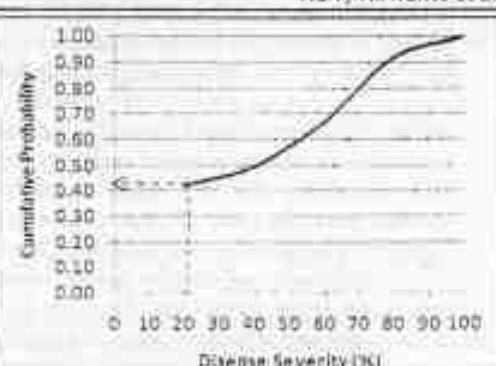
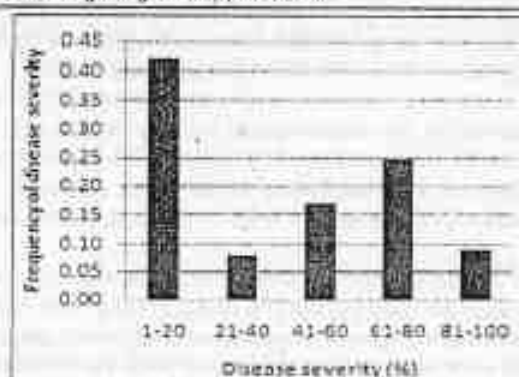


Figure 1. Frequency of estimated disease severity. Figure 2. Cumulative probability curve for purple

Expected net return is calculated based on yield weight in a low epidemic with disease severity less than 21 percent and on more severe epidemic more than 21 percent. From both epidemic the average results calculated by considering the probability values. With a probability value that has been known, it is obtained expected economic values as showed in Table 1.

Table 1. The average value of profit expectations at various intervals of fungicide applications

Schedule	Mean Net Return (Rupiah) when disease severity is Low (P=0.42)      High (P=0.58)		E(NR)* (Thousand rupiah Ha/year)	Increase E(NR) (Thousand rupiah Ha/year)
5-day	19.095.000	30.421.455	25.664	7.077
7-day	17.615.000	19.146.115	18.587	9.202
10-day	10766000	6370742	9.385	4.526
15-day	1.074.300	7.596.480	4.857	

\*assumption on shallot price is Rp. 3000,- per kilogram

Table 1 showed that there were added-returns at all intervals with decreasing intervals of spraying. This suggested that the reduced frequency of spraying could reduce the expected net return. On these results the increase expected net return with the highest amounts occurred in increased frequency of 10-day to 7-day, ie Rp. 9.202 million, but the highest expected net return in controlling purple blotch disease occurred in the schedule of 5-day interval amounted Rp. 25.664 million.

### CONCLUSION

Purple blotch disease epidemic in the region Karangploso, Malang, with low disease severity less than 21% can occur with a probability of 42%. The highest expected net return in this research for purple blotch disease control using fungicide with five-day interval spraying is Rp. 25.664 million.

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